

be, however, that a patient suddenly gets a complete occlusion so that not even a drop of water may pass the cardiospasm. Then gastrostomy must be performed if no expert is at hand able to carry out the described method of dilatation. In Paris, this writer treated a man who for ten years had been lying in the hospital of Vaugirard with a stomach fistula and who had been fed constantly through this fistula. He was cured by one single brusque dilatation. It is my opinion that we can avoid seeing such cases by the use of the proper procedure.

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California's Plan for the Study and Control of Mosquito-Borne Diseases[†]

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THE California legislature has initiated an extensive program for the prevention of mosquito-borne diseases by appropriating \$600,000 for this activity during the present biennium. In the Act it was recognized that further research is necessary to increase the effectiveness of such work. The purpose of this discussion is to describe the administrative approach to this rather complex epidemiologic and disease-control problem. Results of the first year's investigative activities wait upon laboratory examinations now being conducted.

Written records of mosquito-borne disease in California extend back to the days of '49 when malaria was a scourge. Military reports² for July-September 1853 state that the incidence was 816 cases per 1,000 men in Northern California posts. Malaria continued to be a major health problem for decades; as late as 1909, Dr. William F. Snow, Secretary of the State Board of Health, termed it the "minataur" of California.

In 1903, the first mosquito control work in California was undertaken in San Rafael. Sufficient interest was aroused for the passage in 1915 of a Mosquito Abatement District Act which provided that a community could organize its territory into a mosquito abatement district, with funds provided through a tax levy limited at first to 10 cents (now 40 cents) on each hundred dollars of property.

During the ten years following passage of this Act, 15 districts were organized and the incidence of malaria dropped 90 per cent—from a case rate of 17.9 to 1.7 per 100,000.

However, another mosquito-borne disease has become prominent in the Central Valley. Encephalomyelitis was first recognized there in 1930 when approximately 6,000 horses and mules were affected, with a 50 per cent mortality. The malady reappeared in subsequent years, Meyer, Haring, and Howitt³ reported the isolation of a virus as the etiologic agent which later became known as Western equine encephalomyelitis.

Human encephalitis in California, following World War I, occurred primarily in urban areas and during the winter months. It declined to a low point in 1933. Thereafter, the reported incidence of encephalitis began to rise again but the character of the disease was quite different: it was largely a summer disease and appeared in the same rural areas where equine encephalomyelitis was known. Studies¹ proved that the Western equine and St. Louis viruses cause human as well as horse disease and that mosquitoes are a vector. One thousand, three hundred and eighty-three human cases and 453 deaths were reported during the ten-year period 1936-1945. The state was also faced with a possibility of serious human outbreak, such as the mid-western experiences, and the possible importation of Japanese B encephalitis.

Besides the concern with this disease picture, water and power development and expanding

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irrigation areas were constantly adding new elements to the mosquito control problem. There was also a popular fear of the spread of malaria from returning veterans.

RECENT LEGISLATION

With the above considerations in mind the State Senate asked for a report by the Department of Public Health on the disease-bearing mosquito hazard in California. Following submission of the report the Legislature in 1946 enacted a bill "to provide State Assistance of local agencies for the control of mosquitoes," on a 50 per cent matching basis. The Department of Public Health was authorized to "enter into cooperative agreements with any local district or other public agency engaged in the work of controlling mosquitoes . . . under such terms . . . as the State Board of Public Health may prescribe." Of the \$600,000 appropriated, it was specified that not more than \$200,000 was to be spent for studies, demonstrations and administration.

In order to clarify the detailed operations of this program, it is necessary to mention that the California State Department of Public Health includes five divisions—Local Health Services, Administration, Preventive Medical Services, Environmental Sanitation and Laboratories. Bureaus of the latter four divisions all participated in the study program to be described below.

SUBVENTION PROGRAM

The Mosquito Control Section of the Division of Environmental Sanitation was assigned responsibility for allocating the subventions. A staff of engineers and entomologists was assembled to carry out the program and an Advisory Committee established with representation from the University of California, the Hooper Foundation, local health departments and mosquito abatement districts, to assist in establishing criteria for allotting funds.

In applying for funds, a district was required to submit a statement on the prevalence of malaria and human and equine encephalitis, to prepare a map of the district showing cases of the preceding five years and the proposed disease-control area, to present a budget, and to state the qualifications of the person having technical responsibility for the program. The applications were, of course, designed to emphasize the disease-control aspects of mosquito abatement and to bring the districts into close relationship with the health departments. Criteria for allotment of funds included extent and severity of the disease problem and known prevalence of vectors.

The premise of his program is that mosquito control offers the most promising approach to the control of encephalitis, as well as of other mosquito-borne diseases.

Staff members of the mosquito control section assisted the districts in formulating their applications, expanding their programs in accordance with

the latest epidemiologic information and developing entomologic controls for their work.

STUDY PROGRAM

In spite of the strides made during the past decade, our knowledge of the epidemiology of encephalitis has numerous gaps. Are there any reliable clinical differences between encephalitis and non-paralytic poliomyelitis? In recent years, comparatively few cases clinically appearing as encephalitis have been proved due to any of the known viruses. Are other agents involved? From what host does the mosquito acquire the virus and how does the virus persist through the winter? Which of the mosquitoes already implicated is most important, and are there others? What is the most economical way of destroying the known vectors?

In an effort to get further data on these questions, the State Department of Public Health created an intra-departmental committee. Representatives from the fields of epidemiology, veterinary medicine, virology, engineering, entomology, statistics and health education contributed to the plan and met bi-weekly during the season to check on its implementation. This served to bring persons with varied responsibilities into effective cooperation for this one activity.

Before the seasonal rise in incidence occurred, an educational campaign was conducted in order to acquaint appropriate persons with the study and to gain their cooperation. The campaign included visits to mosquito abatement districts, health officers and hospitals, addresses to medical societies, personal contacts and addresses to veterinarians, articles in rural newspapers and journals, and radio programs.

In charge of the office from which the study project operates was placed a statistician who also had responsibility for the development of suitable records.

Health officers report human cases by telephone or teletype. Telephone communication is maintained with epidemiologists in the field who investigate each case. Equine cases are similarly handled, being seen by the veterinarian on the staff. Blood and tissue specimens are submitted to the virus laboratory. All cases are referred to the Mosquito Control Section for entomologic observations.

To indicate the volume of field work this first summer, it may be mentioned that detailed epidemiologic histories were obtained on 136 human and 90 equine cases, and 380 blood and tissue specimens secured from these cases.

In addition to the investigation of equine and human cases, two other field studies were undertaken. One was the collection of suspected vectors and suspected reservoir hosts. A mobile laboratory unit secured specimens from 675 birds and animals, including wrens, owls, pheasants, mud-hens, finches, squirrels, gophers, field mice and many other species. The second project was to study mosquito ecology and to evaluate various methods of control.

Besides these activities of the State Department of Public Health, it should be noted that the fundamental studies of the Hooper Foundation were continued in Kern County, this year, with partial subsidization from the State funds. In several respects, the model for the state program had been established by the Hooper Foundation in previous years.

Although the concentration was on encephalitis, malaria was not overlooked. Data were routinely secured on probable source of infection and preparations were made for investigating any outbreaks. None have occurred as yet.

PROGRESS

Following passage of the legislation, a technical staff of 17 people had to be assembled and trained, the program defined and field work conducted. Investigative results will be reported after completion of laboratory work.

However, certain administrative accomplishments may be mentioned. Of the \$400,000 available for subventions to abatement districts, \$358,613 has already been allotted. Area covered by mosquito abatement districts in the state has been increased from 4,645 square miles to 10,927 square miles. In addition to this extension of mosquito control activities, the quality of work has been improved by emphasis on disease-prevention aspects, by stress upon adequate technical supervision, and by demonstration of new methods.

Wider recognition of the services of the virus laboratory has been reflected in the greatly increased numbers of specimens submitted by

practicing physicians and veterinarians. Clinical consultation service has been well received and has probably enhanced the reliability of reported incidence of neurotropic virus diseases—both human and equine.

The liaison established between the Department of Public Health and veterinarians holds the promise of collaboration against other diseases of mutual interest such as rabies and brucellosis. Steps in this direction are now under consideration.

In summary, it may be stated that a start has been made in applying all the resources of the State Department of Public Health toward the solution of the problems involved in the eradication of mosquito-borne disease, in accord with the present trend toward collaborative research.

As a pattern of intra-departmental organization, the encephalitis program offers an example of planning and carrying out an extensive project involving laboratory, epidemiologic, environmental sanitation, statistical and health educational services. A similar pattern is expected to prove useful in attacking murine typhus, relapsing fever, brucellosis and other diseases.

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